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FUJITSU Software
Interstage Information Integrator V11

An Innovative WAN optimization solution to bring out maximum network performance

December, 2014
Fujitsu Limited

Contents

- Overview
- Key technologies
- Supported network characteristics
- Example cases and performance benchmarks
- Technical architecture
- Deployment model
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Overview

- WAN optimization solution overview
- FUJITSU Software for WAN optimization
- Key features
- Total WAN optimization solution
- Performance benchmark

WAN optimization solution overview

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Challenges

- WAN's characteristics
  - Low bandwidth
  - High latency
  - Packet Loss

- Issues
  - Slow application performance
  - Poor user experience and low productivity
  - Manage servers in branch offices

Solution   WAN optimization

- Overcome both latency and packet loss problems in Wide Area Network
- Accelerate data transmission speed
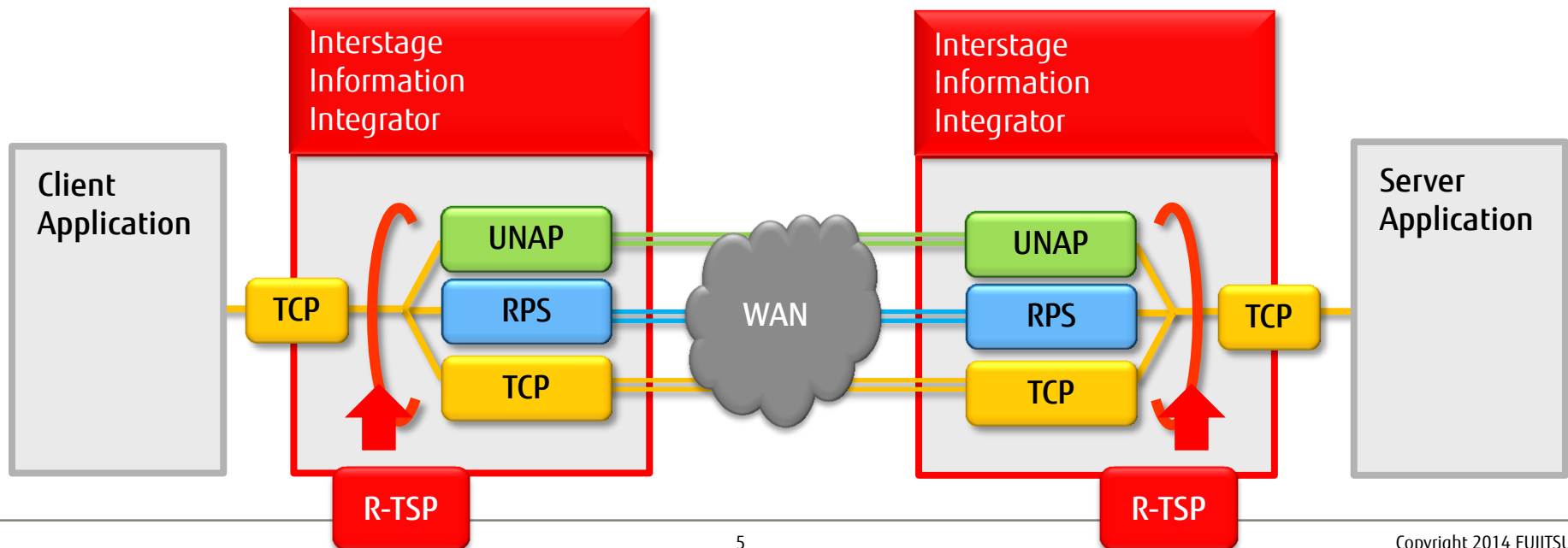- Deliver LAN-like performance to branch offices across the globe

Benefits

- Accelerate the performance of centrally hosted applications
- Improve user experience and boost productivity
- Avoid expensive WAN upgrades and reduce network costs
- Enable key IT initiatives using cloud

FUJITSU Software for WAN optimization

FUJITSU Interstage Information Integrator V11

An Innovative WAN optimization solution to bring out maximum network performance

- ■ Software-based WAN optimization solution
  - ■ Key optimization method: **protocol conversion**
  - ■ Convert TCP to Fujitsu patented proprietary high-performance protocol
    - Random Parity Stream (RPS)
    - Universal Network Acceleration Protocol (UNAP)

Client Application | Interstage Information Integrator | TCP | UNAP | RPS | TCP | WAN | UNAP | RPS | TCP | Interstage Information Integrator | TCP | Server Application | R-TSP | R-TSP

Key features

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- **Innovative technologies**
  - **Random Parity Stream (RPS):** `patent-protected`
    - Patented technology for UDP to recover missing data when packets lost
  - **Universal Network Acceleration Protocol (UNAP):** `patent-pending`
    - UDP-based high-performance protocol with proprietary technologies that control unnecessary packet retransmission
  - **Reconfigurable-Transport (R-TSP):** `patent-pending`
    - Dynamic protocol selection technology
- **Support for a broad range of applications**
  - File sharing, Web, Collaboration, Backup, VDI, Unified communications, etc.
- **Complete network security**
  - Integrated AES encryption algorithm
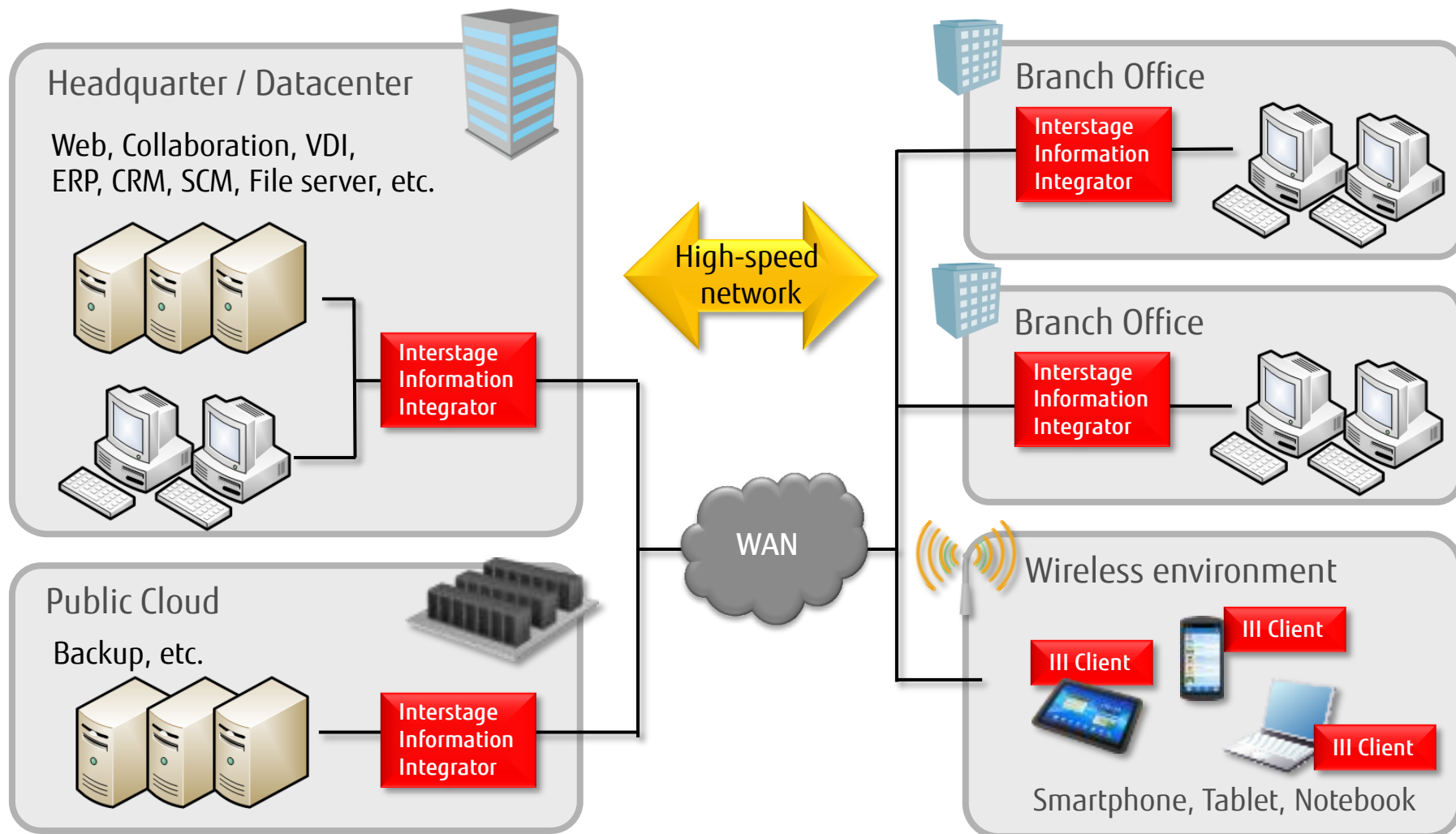 - No cached data on local storage
- **Quick and flexible deployment**
  - Can be placed on existing server due to Software-based WAN optimization
  - No need to change network structure (No cabling)
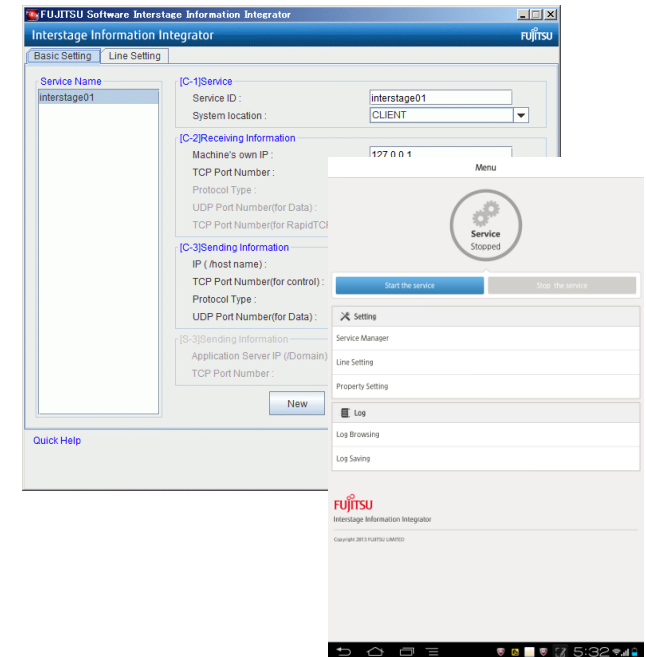
Total WAN optimization solution

- Avoid expensive WAN upgrades and reduce network costs
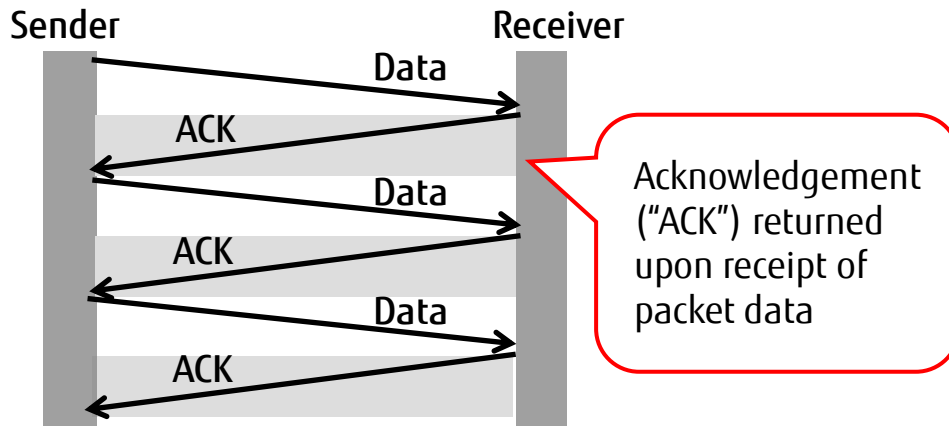- Comprehensive platform support from wireless clients to large-scale datacenters

Headquarter / Datacenter

Web, Collaboration, VDI,
ERP, CRM, SCM, File server, etc.

Interstage
Information
Integrator

Public Cloud

Backup, etc.

Interstage
Information
Integrator

High-speed
network

WAN

Branch Office

Interstage
Information
Integrator

Branch Office

Interstage
Information
Integrator

Wireless environment

III Client

III Client

III Client

Smartphone, Tablet, Notebook

Key technologies

■ **Issues with traditional TCP / UDP**

■ **Fujitsu WAN optimization technologies**

  ■ RPS (Random Parity Stream)

  ■ UNAP (Universal Network Acceleration Protocol)

  ■ R-TSP (Reconfigurable Transport)

  ■ Dynamic Bandwidth Control

Issues with traditional TCP

Pros: good transfer quality   Cons: poor transfer speed

■ Issue with bulk data transfer

Sender   Receiver

Data
ACK
Data
ACK
Data
ACK

Acknowledgement ("ACK") returned upon receipt of packet data

Issue (1)
More volume of data sent, more acknowledgements returned. This process consumes significant time.

Longer RTT (Round Trip Time) takes more time spent for acknowledgements

■ Issue with distant communication

Sender   Receiver

RTT
Data
ACK
RTT
Data
ACK

Network performance drops due to time spent for ACK to reach to the sender
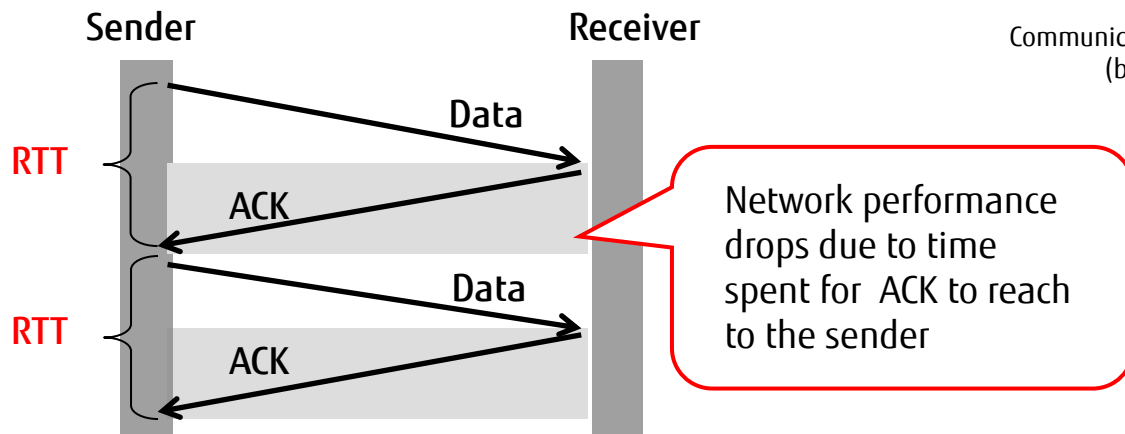
Communication speed (bps)

Issue (2)
Longer RTT takes, more speed drops

RTT (ms)

Issues on traditional UDP

Pros: good transfer speed   Cons: unreliable, line gets occupied

■ **Issue with reliability of data-transfer**

Issue (3)
Unlike TCP, UDP returns no acknowledgement. Therefore, the sender cannot notice any packet loss/mixed-up

(3) Packet mixed-up

(3) Packet loss

Sender

Receiver

(4) Line is occupied by UDP traffic
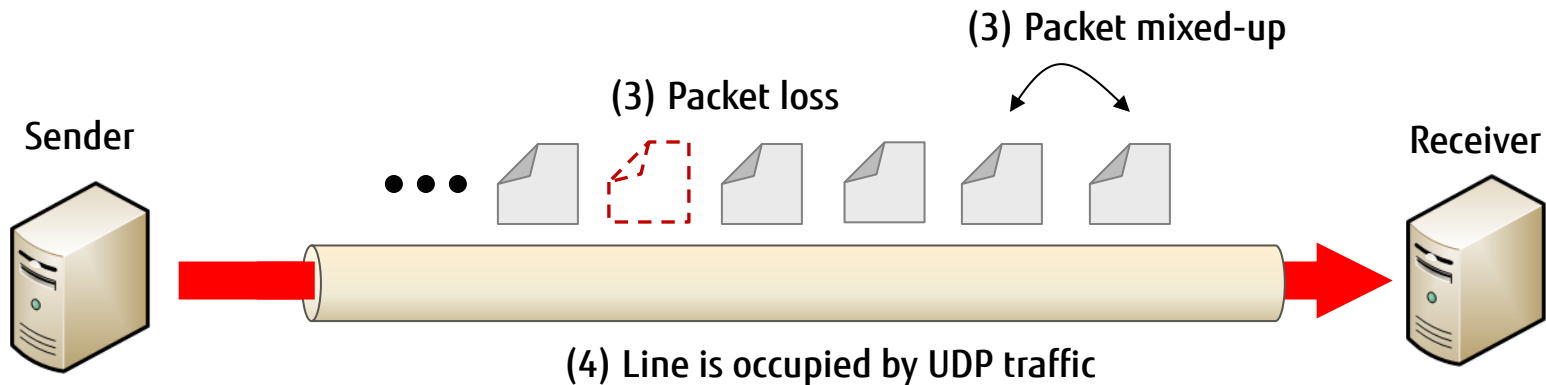
Issue (4)
UDP traffic occupies whole network bandwidth.
Other traffic has to wait for its data-transfer.

Fujitsu WAN optimization technologies

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Type	Technology	Description
High-performance Protocol	Random Parity Stream (RPS) **patent-protected**	Patented technology for UDP to recover missing data when packets lost
	Universal Network Acceleration Protocol (UNAP) **patent-pending**	UDP-based high-performance protocol with proprietary technologies to control unnecessary packet retransmission
	Reconfigurable-Transport (R-TSP) **patent-pending**	Dynamic protocol selection technology to measure and analyze network conditions in real time and dynamically select the most suitable communication method
Quality Management	Dynamic Bandwidth Control	Control consuming bandwidth dynamically
	Transmission Speed Control	Control data transmission speed
Security	Data Encryption	Encrypt data on network (AES:128bit)

RPS (Random Parity Stream)

RPS (Random Parity Stream)

patent-protected

- Patented technology for UDP
  - Create redundant data when it is encoded
    - Redundant data size is less than 10% of data
  - If the packet is lost, it can restore any data using redundant data
  - Avoid packet retransmission

UNAP (Universal Network Acceleration Protocol)
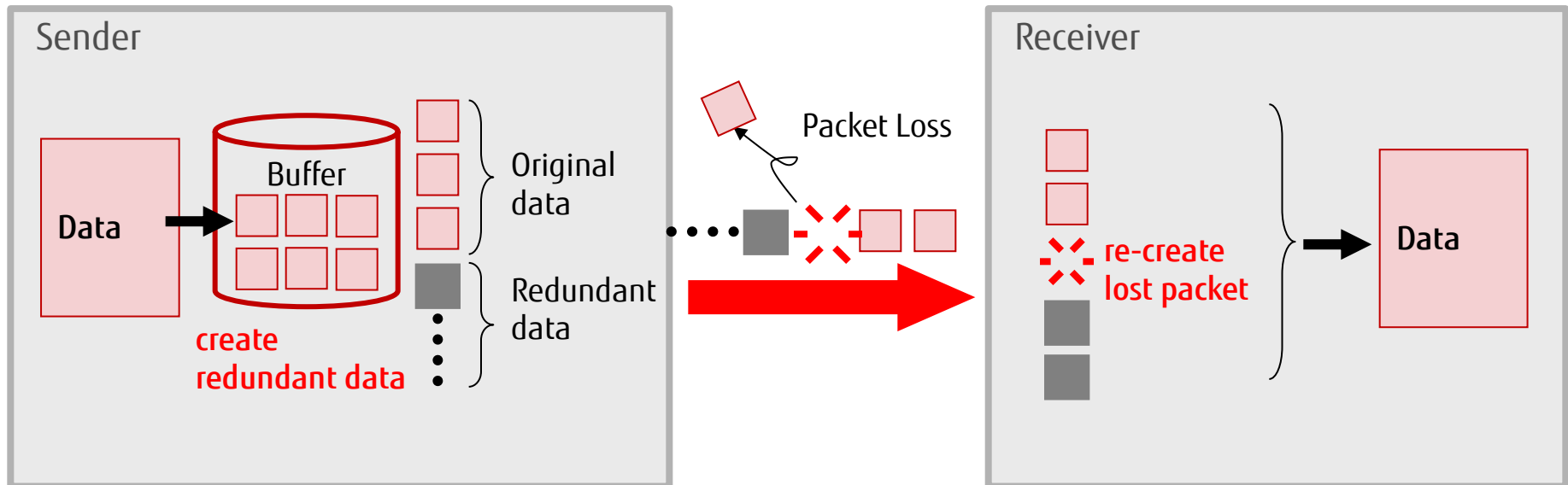
UNAP (Universal Network Acceleration Protocol)

patent-pending

- UDP-based high-performance protocol with proprietary technologies
  - Identify the reason why there may be a delay in delivery
    - packet loss, or temporary congestion on the network
  - If it determines the reason is packet loss, it will then retransmit the lost packet
  - Control unnecessary packet retransmission
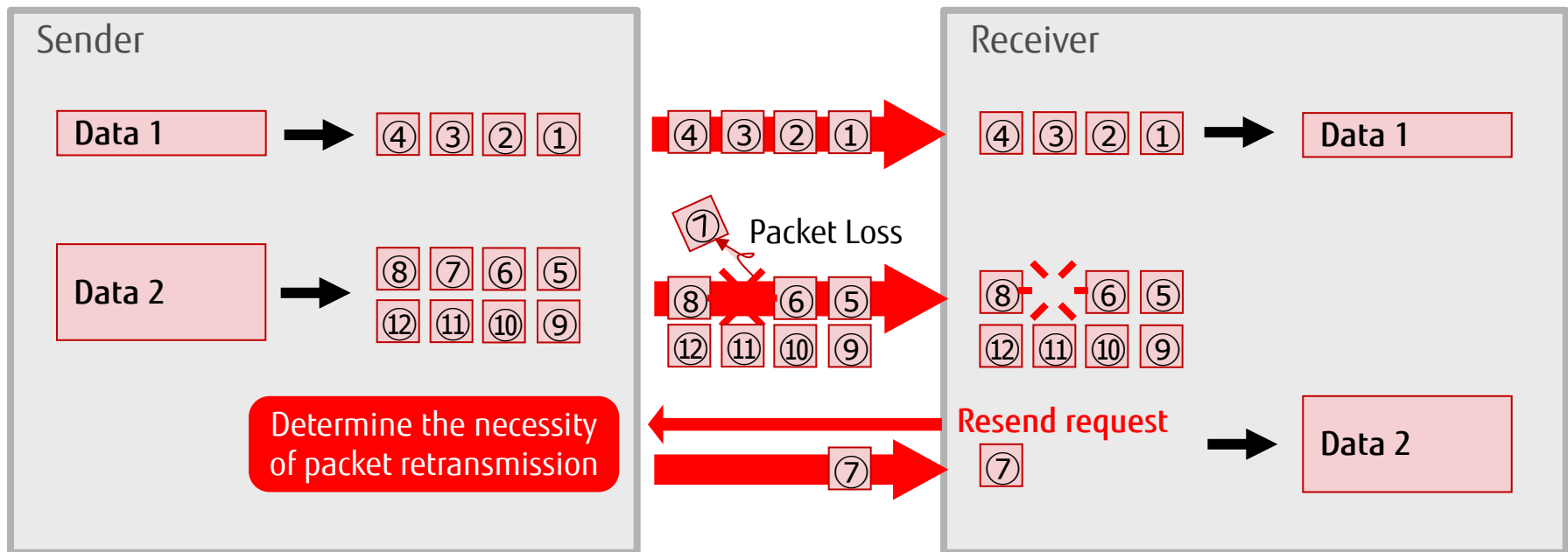
UNAP (Universal Network Acceleration Protocol)

- **Press release was issued by Fujitsu Laboratories on January 29, 2013**
  - http://www.fujitsu.com/global/news/pr/archives/month/2013/20130129-02.html

January 29, 2013
Fujitsu Laboratories Ltd.

Fujitsu Develops New Data Transfer Protocol Enabling Improved Transmissions Speeds

Software-only approach enables over 30 times improvement in file transfer speeds between Japan and the US, reduces virtual desktop operating latency to less than 1/6 of previous levels

Kawasaki, Japan, January 29, 2013 — Fujitsu Laboratories Limited today announced the development of a new data transfer protocol that, by taking a software-only approach, can significantly improve the performance of file transfers, virtual desktops and other various communications applications.

Conventionally, when using transmission control protocol (TCP)[1]—the standard protocol employed in communications applications—in a low-quality communications environment, such as when connected to a wireless network or during times of line congestion, data loss (packet loss) can occur, leading to significant drops in transmission performance due to increased latency from having to retransmit data.

R-TSP (Reconfigurable Transport)

## R-TSP (Reconfigurable Transport)

patent-pending

- Automatically selects the most suitable protocol (UNAP, UDP+RPS, TCP) based on the application and network properties (bandwidth, packet loss rate, latency, RTT, etc.)

- Guarantees the best access for each application flow and maximizes application performance
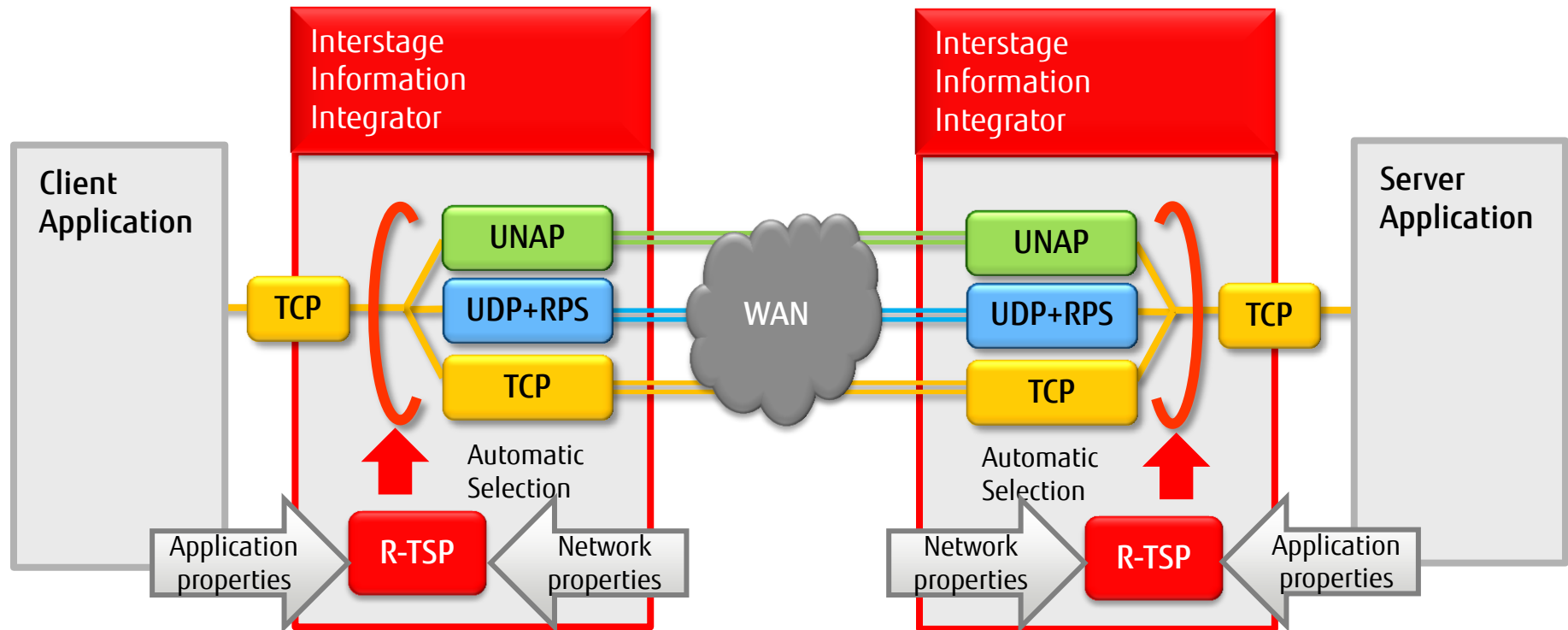
Dynamic Bandwidth Control

Dynamic Bandwidth Control

- Regularly checks the status of the network and actively controls the bandwidth
- Minimizes the impact on other important traffic and utilizes existing network bandwidth in the most efficient way
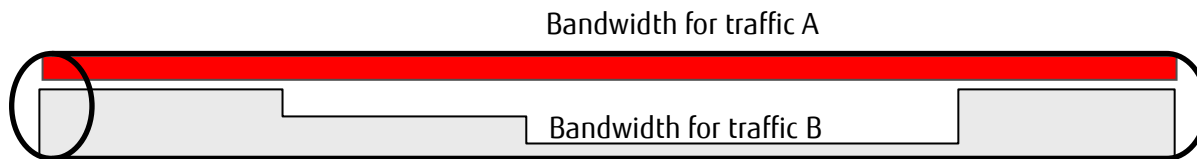
Dynamic Bandwidth Control

FUJITSU
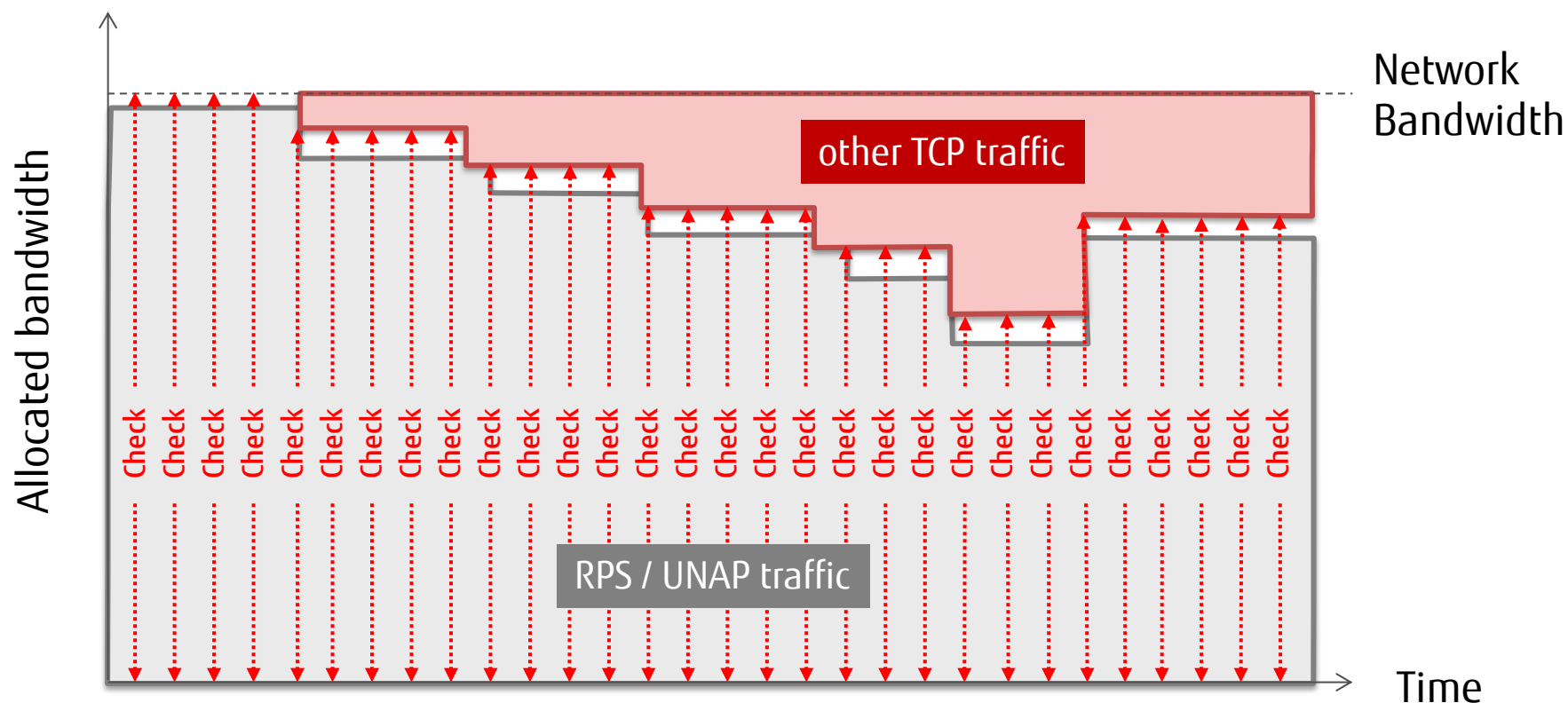
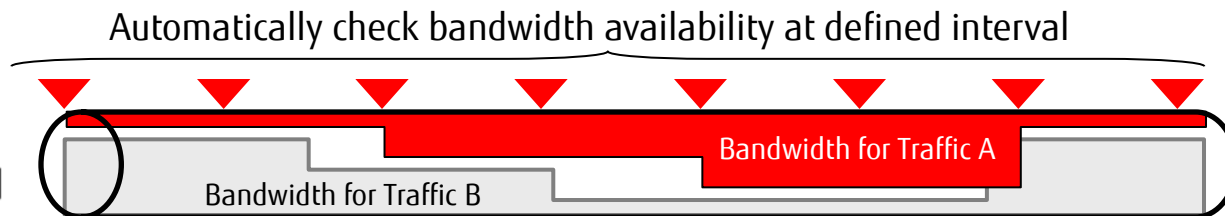**Without bandwidth control**

Bandwidth for Traffic A

Other traffic is interrupted

Static bandwidth control

Bandwidth for traffic A

Bandwidth for traffic B

Control bandwidth to minimize an impact on other important traffic

Dynamic bandwidth control

Automatically check bandwidth availability at defined interval

Bandwidth for Traffic A

Bandwidth for Traffic B

Dynamically control bandwidth to utilize maximum bandwidth while minimizing an impact on other important traffic

Supported network characteristics

- Network type and effectiveness
- Applicable protocol diagram
- Protocol performance comparison

Network type and effectiveness

Applicable network type and technology

■ Broadband internet, Wireless networks, Satellite networks, Leased line, IPsec-VPN

　　■ SSL-VPN is not supported

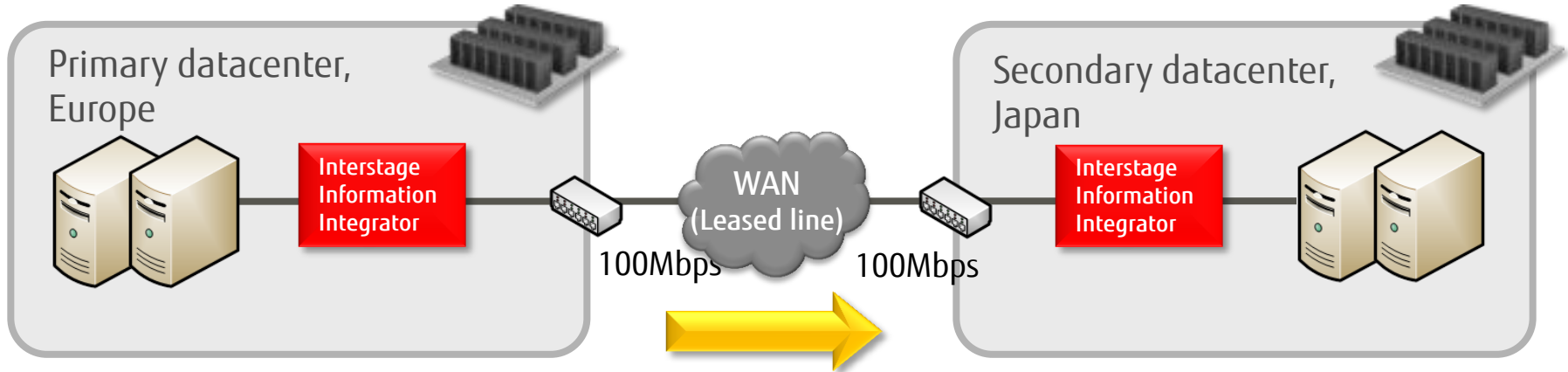| Factor		Effectiveness of III WAN optimization		
		Low		High
1	Round Trip Time (RTT) (ms)	40		200~
2	Packet loss rate (%)	0.01		1.0~
3	Bandwidth (Mbps)	3		100~
4	Transfer data size (MB)	1		300~
5	Application type	Chatter application with frequent communication	~	Bulk communication

Example cases and performance benchmarks

- Applicable applications
- Backup
- Enterprise Content Management
- Secured Delivery System
- Virtual Desktop Infrastructure
- Wireless environment

Applicable application example

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Type	Application (Protocol)
File Sharing	Windows (CIFS)
Web	Web-based applications (HTTP / HTTPS) for file downloading/uploading
File Transfer Software	HULFT 7 (Japan only)
Backup / Replication	Backup and replication applications from leading vendors
CAD	FTCP Remote Desktop (Japan only)
Remote Desktop	Windows RDP, Citrix XenDesktop(*1)

*1: Citrix XenDesktop with DHCP mode is not supported

Backup

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- ■ Data backup from primary datacenter to secondary datacenter

Primary datacenter,
Europe

Interstage Information Integrator

100Mbps

WAN
(Leased line)

100Mbps

Secondary datacenter,
Japan

Interstage Information Integrator

Benchmark Result

- ■ International WAN : Europe – Japan
  - ■ Bandwidth: 100Mbps, Latency: 250ms, Loss rate: 0.1%

22x faster

	File size	Without III	With III	Results
Backup	10 GB	7 hours 20 min	20 min	22x faster

Enterprise Content Management

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■ Delivery of Technical information and documents

Office, USA
Interstage Information Integrator
15Mbps
WAN (Internet)
100Mbps
Datacenter, Japan
Interstage Information Integrator
Enterprise Content Management System
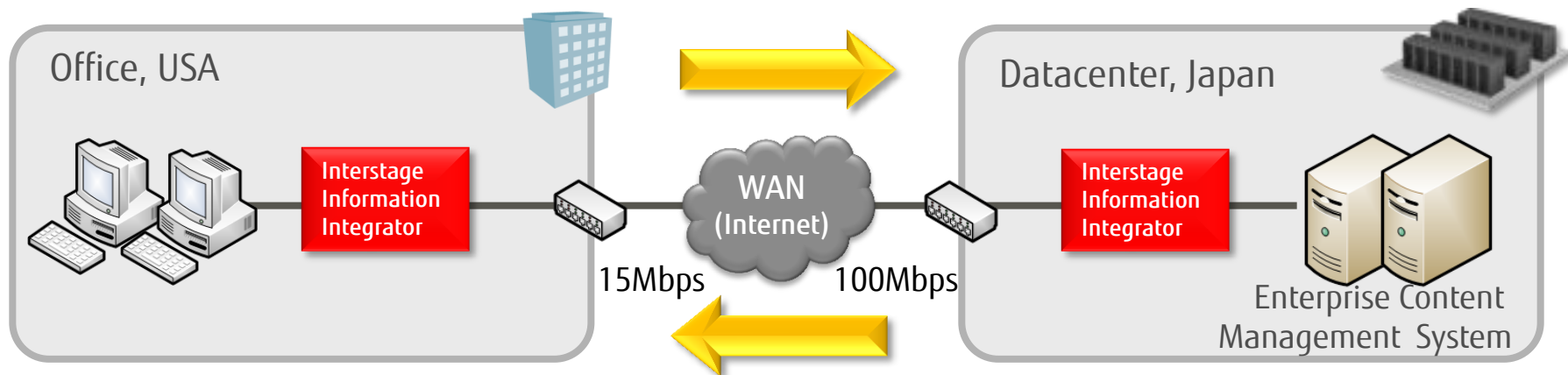
Benchmark Result

■ International WAN : USA - Japan
■ Bandwidth: 15Mbps, RTT: 250ms

maximum 27x faster

	File size	Without III	With III	Results
Upload	1 MB	9 sec	1 sec	9x faster
(USA-Japan)	30 MB	180 sec	7 sec	26x faster
Download	1 MB	13 sec	1.5 sec	9x faster
(USA-Japan)	30 MB	350 sec	13 sec	27x faster

Secured Delivery System

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- Delivery of high-volume data file on HTTPS through III protocol

Office, Europe — Interstage Information Integrator — Upload — 10Mbps → WAN — 100Mbps — Interstage Information Integrator — Datacenter, Japan

Office, USA — Interstage Information Integrator — 10Mbps — Download — Secured Delivery System
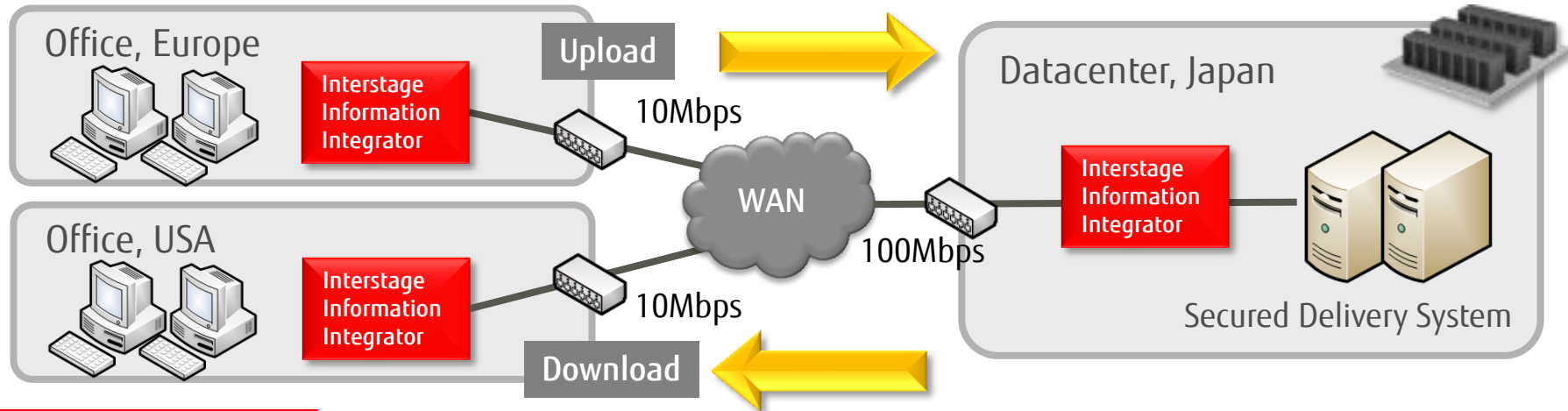
Benchmark Result

- International WAN : Europe/USA - Japan
  - Bandwidth: 10Mbps, RTT：240ms, Loss rate：1.0%

maximum 27x faster

	File size	No. of clients	Without III	With III	Results
Upload	10 MB	1 pcs	295 sec	11 sec	27x faster
(Europe-Japan)	10 MB	5 pcs	310 sec	14 sec	22x faster
Download	10 MB	1 pcs	205 sec	11 sec	19x faster
(USA-Japan)	10 MB	5 pcs	240 sec	17 sec	14x faster

Virtual Desktop Infrastructure

- **Delivery of virtual desktop image hosted on datacenter to office**
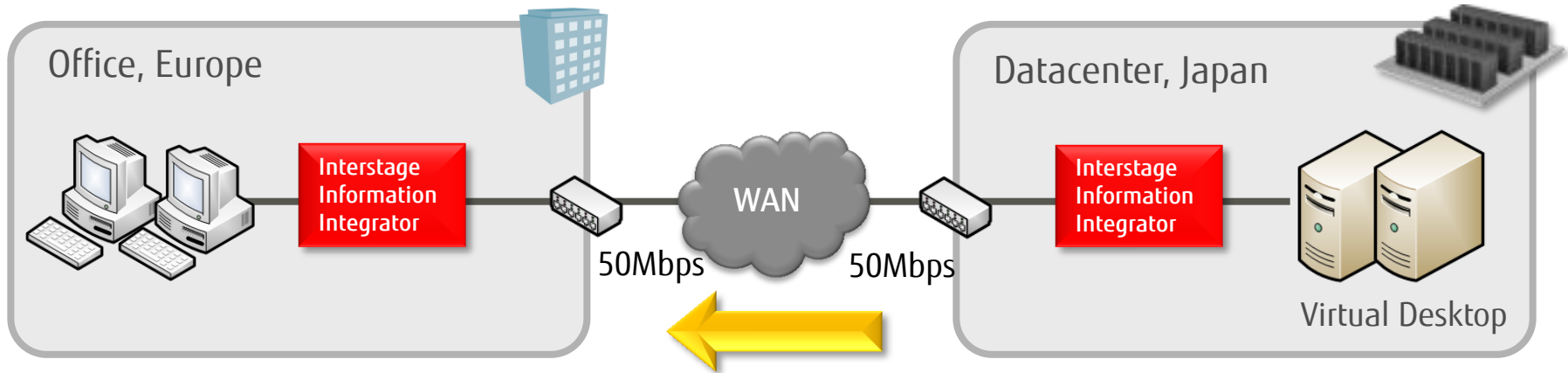
Benchmark Result
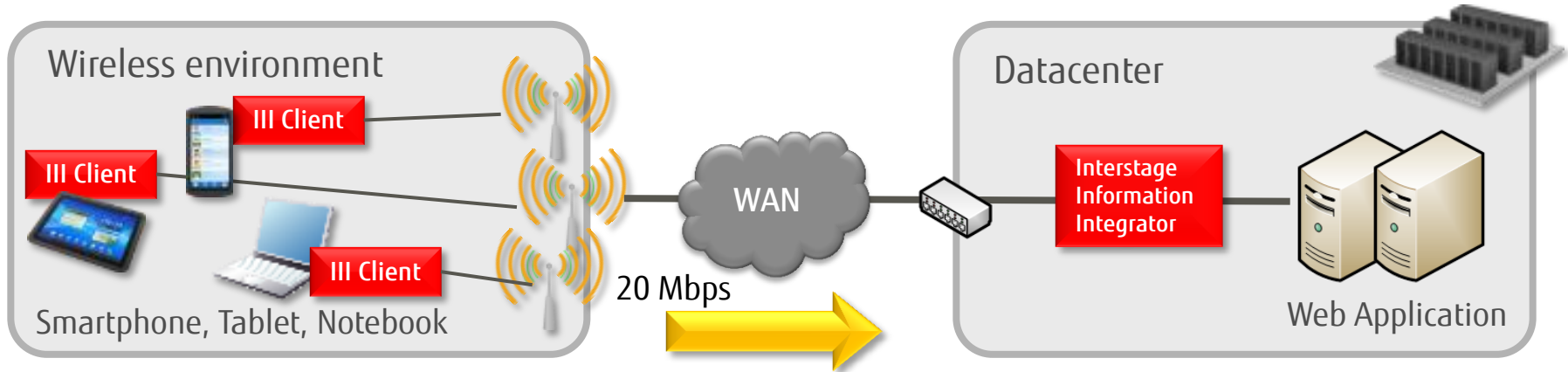
- **International WAN : Europe – Japan**
  - Bandwidth: 50Mbps, Latency: 250ms, Loss rate: 0.1%

4.6x faster

	Without III	With III	Results
Waiting time	2.3 sec	0.5 sec	4.6x faster

Wireless environment

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- ## Access to web application from mobile devices via wireless network

Benchmark Result

- ## Wireless network
  - Bandwidth: 20Mbps, Latency: 150ms, Loss rate: 0.1%

5x faster

	Without III	With III	Results
Waiting time	5 sec	1 sec	5x faster

Technical architecture

- Technical architecture
- Communication flow
- Environment setting overview
- Setting screen sample (Windows / Android)

Technical architecture

■ Protocol Conversion

- Convert TCP/IP protocol to high-performance protocol (UNAP, UDP+RPS) at lower layer
- No need to modify applications

Client Application	III (client-side)	III (server-side)	Server Application
Application	Application	Application	Application
Presentation	**Protocol conversion**	**Protocol conversion**	Presentation
Session	Session	Session	Session
Transport	Transport	Transport	Transport
Network	Network	Network	Network
Data Link	Data Link	Data Link	Data Link
Physical	Physical	Physical	Physical

(1) TCP/IP

Proxy address

WAN

(2) High-performance protocol (UNAP, UDP+RPS)

(3) TCP/IP

Communication flow

(1) Client Application transmits data to client-side III

(2) Client-side III converts the data from Client application into UNAP or UDP+RPS

(3) Client-side III transmits data to server-side III

(4) Server-side III converts the data from client-side III into TCP

(5) Server-side III transmits data to Server Application

Client Application	III (client-side)	III (server-side)	Server Application
IP: 192.168.2.150	IP: 192.168.2.161	IP:192.168.2.162	IP:192.168.2.170

(1) → TCP port: 80

(2) protocol conversion

(3) → UDP port: 5100

(4) protocol conversion

(5) → TCP port: 80

Environment setting overview

Client Application

IP: 192.168.2.150

Interstage Information Integrator (client-side)

IP: 192.168.2.161

Interstage Information Integrator (server-side)

IP:192.168.2.162

Server Application

IP:192.168.2.170

[C-1] / [S-1] Service
Service ID : Interstage 01

[A-1] Destination
IP:192.168.2.161
Port : 80

[C-2] Receiving Information
Machine's own IP : 192.168.2.161
TCP port Number : 80

[C-3] Sending Information
IP (host name) : 192.168.2.162
TCP Port Number (for control) : 7100
Protocol Type : R-TSP
UDP Port Number (for data) : 5100

[S-2] Receiving Information
Machine's own IP : 192.168.2.162
TCP Port Number : 7100
Protocol Type : R-TSP
UDP Port Number (for data): 5100
TCP Port Number (for Rapid TCP): 5100

[S-3] Sending Information
Application Server IP (Domain) :
                    192.168.2.170
TCP Port Number : 80

Waiting port : 80

◯ : TCP port number that is necessary to consider the firewall settings
◯ : UDP port number that is necessary to consider the firewall settings

Setting screen sample (Windows)

Setting screen sample (Windows)

Line Setting (Client / Server)

Setting screen sample (Android)

Setting screen sample (Android)

Service Setting

Service Setting

Service

Service ID
interstage01

Receiving Information

Machine's own IP
127.0.0.1

TCP Port Number
80

Sending Information

IP (/host name)
192.168.2.162

TCP Port Number(for control)
7100

Protocol Type
R-TSP

UDP Port Number(for Data)
5100

Line Setting

Line Setting

Line Measurement Cycle(second)
30

Network Bandwidth usage rate(%)
100

Maximum Line speed(Mbps)
80.0

Minimum Line speed(Mbps)
0.1

Encryption
Not Use

Send Buffer(KB)
32000

Receive Buffer(KB)
64000

EventViewer/Syslog
ERROR

TCP Port Number(for R-TSP)
20010

Rapid TCP
Enabled

Deployment model

- ■ Proxy environment
- ■ Load balancing environment
- ■ SSL-VPN environment

Proxy environment

- Traffic using III needs to detour the proxy server
- Client and server have to communicate without going through proxy

Client PC

Web Client

HTTP Proxy

WAN

Server

Web Server

Interstage Information Integrator

WAN

Interstage Information Integrator

Server

Web Server

Select network path
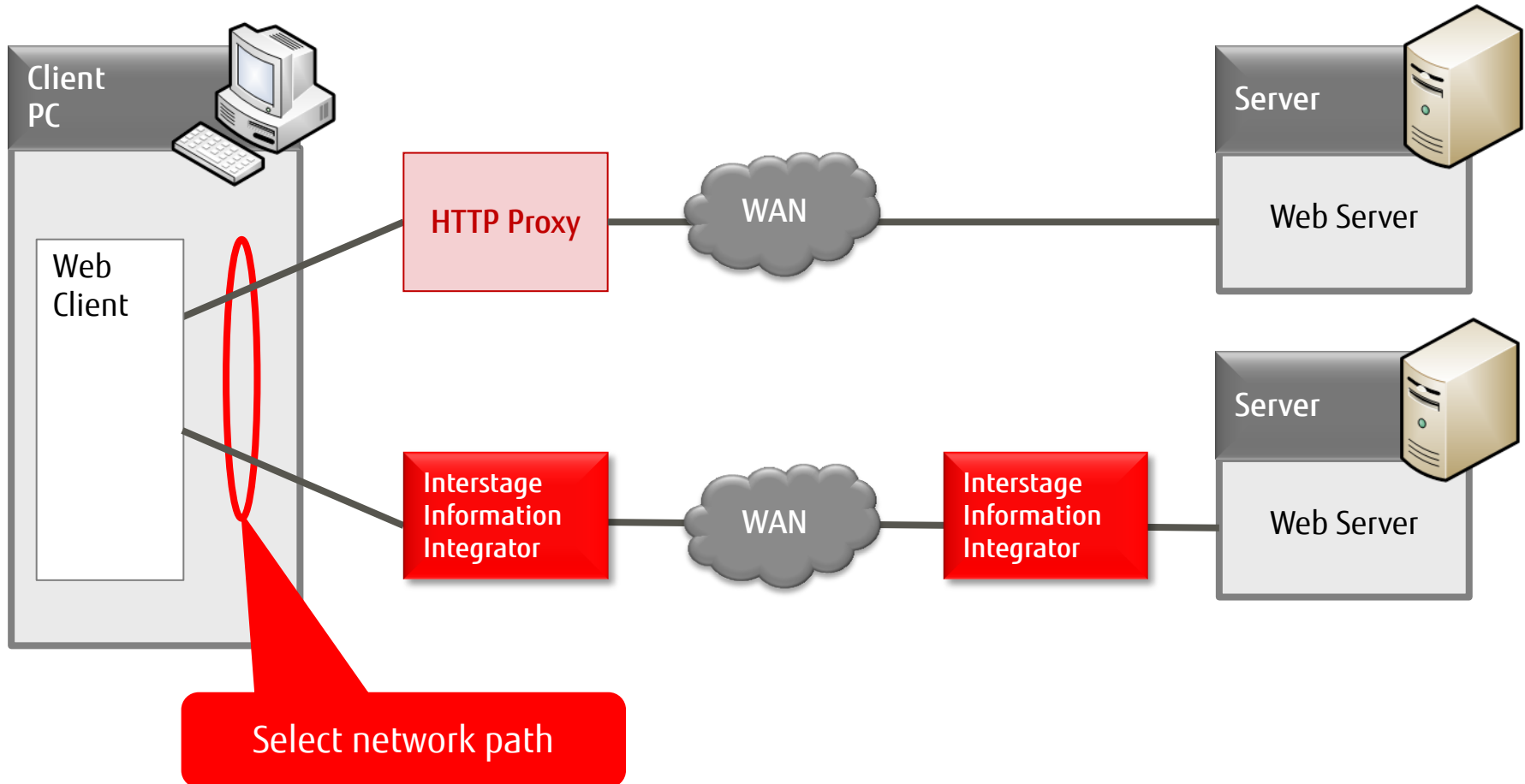
Load balancing environment

■ **Configuration requiring load balancing**

  ■ Deploy sever-side III in front of a load-balancer

Client-side

Server-side

Interstage Information Integrator

WAN

Interstage Information Integrator

Load balancer

Client PC recognizes several servers as 'only one server'

Flexibly balance workload according to the congestion status (round robin, etc.)

SSL-VPN environment
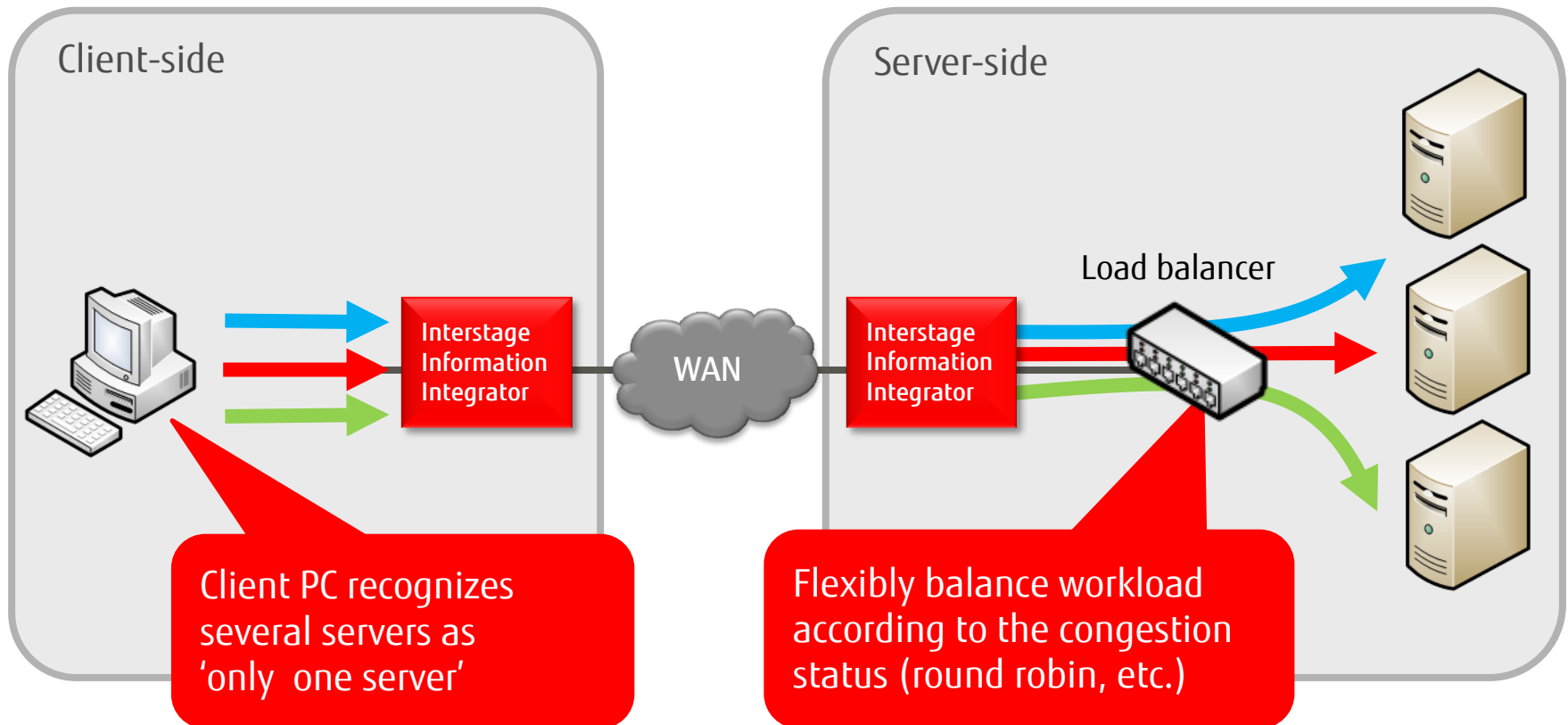
Reference example - Reason for no sufficient result on SSL-VPN

- III converts TCP to high-performance protocol (UNAP, UDP+RPS)
- However, SSL-VPN encapsulates UDP protocol into HTTPS protocol(TCP)
- HTTPS protocol (TCP) causes extra waiting time affecting its RTT
- For this reason, sufficient acceleration cannot be performed
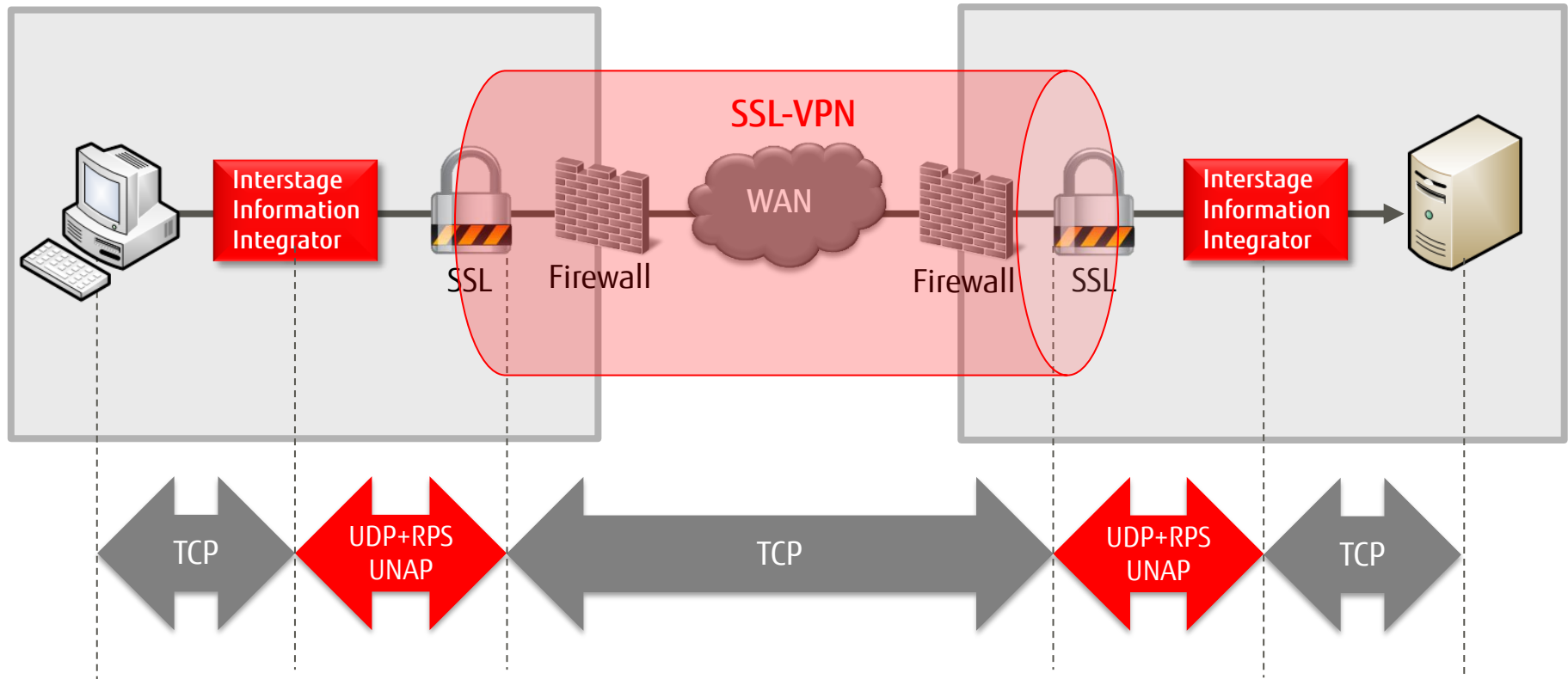
Competitive advantage

- ■ III Characteristics

III Characteristics

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- ## Application
  - Optimizes **only the traffic of targeted application in the WAN traffic**.
    - Allows you to optimize **without impacting other traffics**.
  - Can select the target application to be optimzed.

- ## Deployment
  - **Software-based WAN opmization solution**.
    - Can be deployed **on virtual environment or existing server without changing any existing network configuration**.
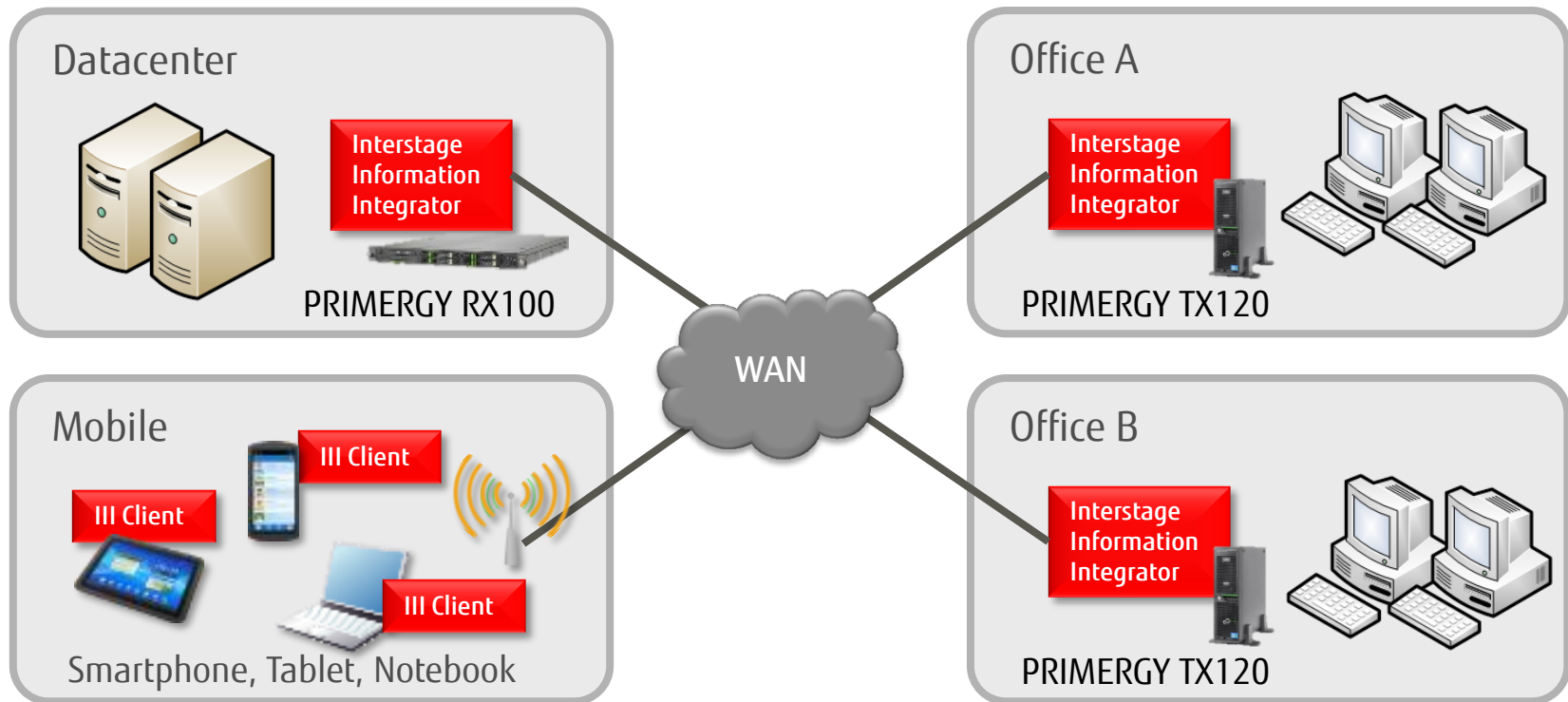 - Configure target applciation to send traffic to III.

Product lineup

- ■ License scheme
- ■ License model example
- ■ System requirements

License scheme

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Product	License scheme	Appropriate for
Interstage Information Integrator **Standard Edition**	Needs to be purchased per processor on server **Single-core processors** ■ One processor license is required per processor **Multi-core processors** ■ Licenses equal to the total number of cores multiplied by the relevant coefficient must be purchased (decimals rounded up) <table><tr><th>Processor type</th><th>Coefficient</th></tr><tr><td>Intel (excl. Itanium)</td><td>0.5</td></tr><tr><td>AMD</td><td>0.5</td></tr></table>	Datacenter Branch office
Interstage Information Integrator **Client License**	Needs to be purchased in line with the number of client devices (Smartphone, Tablet, Notebook)	Mobile users

License model example

Required Licenses

- Datacenter: 1x PRIMERGY RX100 (4 cores, Xeon) + **2x III Standard Edition Licenses**
- Office A: 1x PRIMERGY TX120 (2 cores, Pentium) + **1x III Standard Edition License**
- Office B: 1x PRIMERGY TX120 (2 cores, Pentium) + **1x III Standard Edition License**
- Mobile: 10x Tablet/Smartphone/Notebook + **10x III Client Licenses**

Datacenter

Interstage Information Integrator

PRIMERGY RX100

Office A

Interstage Information Integrator

PRIMERGY TX120

Mobile

III Client
III Client
III Client

Smartphone, Tablet, Notebook

WAN

Office B

Interstage Information Integrator

PRIMERGY TX120

System requirements

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- ■ Hardware

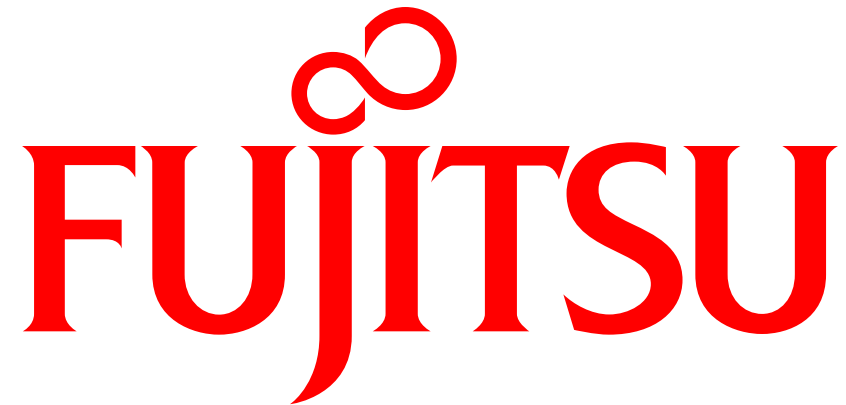|	Specifications
Server	Memory: more than 2GB, Disk: more than 1GB free space
Client	Memory: more than 1GB, Disk: more than 50MB free space
Smart device	Memory: more than 1GB, Disk: more than 30MB free space

- ■ Operating System

	Specifications
Windows	FUJITSU PC, PRIMERGY, PRIMEQUEST, FUJITSU Cloud IaaS Trusted Public S5, AT compatible machine
	Microsoft Windows Server 2003, 2008, 2012 Microsoft Windows Vista, 7, 8
Linux	PRIMERGY, PRIMEQUEST, FUJITSU Cloud IaaS Trusted Public S5
	Red Hat Enterprise Linux 6
Solaris	SPARC M10, SPARC Enterprise, PRIMEPOWER, S Series
	Oracle Solaris 10, 11
Android	Smart device equipped with Android
	Android OS 4.0, 4.1, 4.2

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shaping tomorrow with you